CLAIMS

1. A method for improving the quality of transportation of selected data packets over a data network, comprising:
   a) determining selected nodes as access points to said data network, each of which may be a source node from which said selected data packets can be transmitted, or a destination node to which said selected data packets can be intended;
   b) selecting one or more intermediate nodes, for generating a plurality of alternative paths, between said source node and said destination node, each one of said alternative paths consists of segments and includes one or more intermediate node(s), for routing said selected data packets;
   c) periodically testing the packet transportation parameters in the segments of each preselected path, each time by sending a plurality of test packets from said source node to said destination node, along said preselected paths defined by different intermediate nodes, the addresses of which are known to said source node,
   d) defining one or more optimal paths, being selected from said alternative paths, for delivering said selected data packets from said source node to said destination node according to said tested transportation parameters and optionally, also according to predefined parameters characterizing said segments by selecting a combination of segments, connected to nodes, and having the optimal tested transportation parameters and/or predefined parameters, that connects said source node to said destination node;
   e) for each selected data packet, generating a modified header containing a single address, or sequence of consecutive addresses that correspond to consecutive nodes along an optimal path, and attaching said modified header to said selected data packet;
   f) forwarding each selected test/data packets from said source node to said destination node along said optimal path(s), while at each intermediate node, along said optimal path, starting from the source:
      f.1) processing said modified header;

f.2) extracting the address that corresponds to the next consecutive intermediate node;

f.3) forwarding said selected data packet from said intermediate node to its consecutive intermediate node using the extracted address;

f.4) repeating steps f.1) to f.3) for all intermediate nodes until said destination node; and

g) at the destination node, removing said modified header from said selected data packet and, whenever desired, allowing using its original header.

2. A method according to claim 1, wherein the data network is the Internet, or any other type of IP-based network.

3. A method according to claim 1, wherein one or more nodes are used as intermediate nodes.

4. A method according to claim 1, wherein the test packet does/does not contain.

5. A method according to claim 1, wherein the transportation parameters are selected from the following group of parameters:
   - the delay time of data packets from source to destination;
   - the variance of said delay time; and
   - loss of packets.
   - Data rate (throughput)

6. A method according to claim 1, wherein data is concurrently delivered from a source node to a destination node over several different paths.

7. A method according to claim 6, further comprising using weighted distribution of data between paths.

8. A method according to claim 7, wherein the weighted distribution is determined according to the desired level of QoS between the source node and the destination node.

9. A method according to claim 4, wherein the definition of the optimal path is carried out by measuring and storing the time and/or the order of arrival of test packets through different paths from the source node to the destination node.

10. A method according to claim 1, further comprising:
    a) dynamically varying the definition of each optimal path from the source node to the destination node, according to the testing results, or by employing a threshold mechanism; and
    b) whenever a new optimal path is defined, continuing sending data packets from said source node to said destination node over said new optimal path.

11. A method according to claim 1, wherein the optimal path consists of direct connection between the source node and the destination node.

12. A method according to claim 1, wherein the predefined parameters are selected from the following group of parameters:
    - cost;
    - availability;
    - agreements with ISPs;
    - data type;
    - agreement with customers;
    - Date and/or time.

13. A method according to claim 1, wherein a QoS grade is assigned to each alternative path according to the tested transportation parameters and/or

predefined parameters that correspond to a required QoS and/or to the type of data packets to be sent from the source node to the destination node.

14. A method according to claim 13, further comprising dynamically varying the QoS grade of at least one optimal path according to the tested transportation parameters and/or to the type of data packets to be sent from the source node to the destination node.

15. A method according to claim 13, wherein packets of an application, the type of which being selected from the group of {data, voice, video, multimedia}, are sent from the source node to the destination node through one or more optimal paths being optimal for the corresponding application type.

16. A method according to claim 13, further comprising splitting the transportation of data packets from the source node to the destination node between two or more optimal paths, such that more transportation is directed to, and distributed between, optimal paths having higher grades than the remaining optimal paths, and less transportation is directed to, and distributed between, said remaining optimal paths.

17. A method according to claim 1, wherein each one of the optimal paths, between a source node and a destination node, includes only one intermediate node, said intermediate node being a Router (RQnode) that is selected from one of the inherent Internet's backbone Routers, the address of which is known to said source node and the selected packets are transmitted from said source node to said destination node, via said RQnode, by generating, in said source node, a modified header, according to a first Header Modification Rule (HMR) rule.

18. A method according to claim 1, wherein each one of the optimal paths, between a source node and a destination node, includes at least two consecutive intermediate nodes, said intermediate nodes being BackBone

Qnodes (BBQs) that are connected to strategic points in the Internet, the addresses of which are known to said source node and the selected packets are transmitted from said source node to said destination node, via the corresponding consecutive BBQs, by generating and attaching, in said source node, a modified header to said selected packets, said modified header is obtained by employing a second Header Modification Rule (HMR) rule, after which said modified header contains a corresponding sequence of consecutive addresses that corresponds to consecutive BBQs along the corresponding optimal path, said second rule comprises adding, to the header of said selected packets, the addresses of said BBQs, in an order which corresponds to the order of said consecutive BBQs nodes along said optimal path, starting from the destination node to the BBQ being directly connected to said source node, so that whenever said selected packets are forwarded to one of said BBQs, the address of the current BBQ is removed from the header of said selected packets, thereby revealing the address of the next BBQ, for allowing said current BBQ to forward said packets, until said packets reach the destination node.

19. A method according to claims 17 and 18, wherein each one of several optimal paths, between a source node and a destination node, includes one intermediate node (RQnode) and each one of the remaining optimal paths include at least two consecutive intermediate nodes (BBQs) that are connected to strategic points in the Internet, the addresses of said Routers and said BBQs being known to said source node, said source node being capable of determining which selected packets should be forwarded to the destination node via a Router (RQnode) or BBQs, and, accordingly, selecting the corresponding HMR rule, according to which the header of the corresponding packets is to be modified.

20. A method according to claims 17 and 18, wherein one, or more, optimal path(s) comprise(s) a combination of RQnode(s) and BBQ(s), being utilized as intermediate nodes, and the first/second HMR rules are employed by the corresponding source/BBQ node according to said combination.

21. A method according to claims 17, 19 and 20, wherein according to the first HMR rule, the address of the source node is replaced in the header of the selected packets, by said source node, with the address of the destination node, by employing the Internet Communication Massage Protocol (ICMP), in order to cause the corresponding intermediate node Router (RQnode) to forwarded said selected packets to said destination node.

22. A method according to claim 1, wherein a source/destination node may be utilized as intermediate node for other source/destination nodes.

23. A method according to claim 1, wherein the preselected alternative paths include a path that is a default path, which allows transferring data between the source node and the destination node by utilizing conventional software packages.

24. A data network having improved quality of transportation of selected data packets, comprising:

a) a plurality of nodes being access points to said data network, each of which may be a source from which said selected data packets can be sent, or a destination to which said selected data packets can be intended;

b) a plurality of intermediate nodes between said source and said destination, for generating a plurality of alternative paths, consisting of segments, for routing said selected data packets;

c) at one or more nodes and/or intermediate nodes, circuitry for sending a plurality of test packets from said source to said destination, along said preselected different paths defined by different intermediate nodes and their corresponding interconnecting segments;

d) processing means, for defining one or more optimal paths for delivering said selected data packets from said source to said destination according to said transportation parameters and optionally, also according to predefined parameters characterizing said segments, and for selecting a combination of segments, connected to nodes, and having the optimal sampled transportation parameters and/or predefined parameters, that connect said source to said destination;

e) at each source, processing means for generating a modified header, for each selected data packet, that contains a sequence of consecutive addresses that correspond to consecutive nodes along an optimal path and attaching said modified header to said selected data packet;

f) at each node along said optimal path, starting from the source:

f.1) processing means for processing said modified header and for extracting the address that corresponds to the next consecutive node;

f.2) circuitry for forwarding said selected data packet from said node to its consecutive node along said optimal path using the extracted address; and

g) at the destination node, processing means for removing said modified header from said selected data packet and for obtaining the original header of said selected data packet.

25. A data network according to claim 24, wherein the data network is the Internet.

26. A data network according to claim 24, in which one or more nodes are used as intermediate nodes.

27. A data network according to claim 24, in which the test packet does not contain a payload.

28. A data network according to claim 24, in which the transportation parameters are selected from the following group of parameters:

- the delay time of data packets from source to destination;
- the variation of said delay time; and
- loss of packets.

29. A data network according to claim 24, in which data is concurrently delivered from a source to a destination over several paths.

30. A data network according to claim 29, comprising weighted distribution of data between paths.

31. A data network according to claim 30, in which the weighted distribution is determined according to the desired level of QoS between the source and the destination.

32. A data network according to claim 27, in which the definition of the optimal path is carried out by measuring and storing the time and/or the order of arrival of test packets through different paths from the source to the destination.

33. A data network according to claim 24, further comprising:
processing means for dynamically varying the definition of each optimal path from the source to the destination, according to the sampling results, and for sending data packets from said source to said destination over said new optimal path.

34. A data network according to claim 24, in which the optimal path consists of direct connection between the source and the destination.

35. A data network according to claim 24, in which the predefined parameters are selected from the following group of parameters:
- cost;

- availability;
- agreements with ISPs;
- data type;
- agreement with customers.
- Date and/or time

36. A data network according to claim 24, in which a grade is assigned to each optimal path according to the sampled transportation parameters and/or predefined parameters that correspond to a required QoS and/or to the type of data packets to be sent from the source to the destination.

37. A data network according to claim 36, further comprising processing means for dynamically varying the grade of at least one optimal path according to the sampled transportation parameters and/or to the type of data packets to be sent from the source to the destination.

38. A data network according to claim 36, in which voice packets are sent from the source to the destination through one or more optimal paths being optimal for voice.

39. A data network according to claim 36, wherein data packets are sent from the source to the destination through one or more optimal paths being optimal for data.

40. A data network according to claim 36, comprising processing means for splitting the transportation of data packets from the source to the destination through between two or more optimal paths, such that more transportation is directed to, and distributed between, optimal paths having higher grades than the remaining optimal paths, and less transportation is directed to, and distributed between, said remaining optimal paths.

41. A data network according to claim 24, wherein each one of the optimal paths, between a source node and a destination node, includes only one intermediate node, said intermediate node being a Router (RQnode) that is selected from one of the inherent Internet's backbone Routers, the address of which is known to said source node and the selected packets are transmitted from said source node to said destination node, via said RQnode, by generating, in said source node, a modified header, according to a first Header Modification Rule (HMR) rule.

42. A data network according to claim 24, wherein each one of the optimal paths, between a source node and a destination node, includes at least two consecutive intermediate nodes, said intermediate nodes being BackBone Qnodes (BBQs) that are connected to points in the Internet, the addresses of which are known to said source node and the selected packets are transmitted from said source node to said destination node, via the corresponding consecutive BBQs, by generating and attaching, in said source node, a modified header to said selected packets, said modified header is obtained by employing a second Header Modification Rule (HMR) rule and containing a corresponding sequence of consecutive addresses that correspond to consecutive BBQs along the corresponding optimal paths, said second rule comprises adding, to the header of said selected packets, the addresses of said BBQs, in an order which corresponds to the order of said consecutive BBQs nodes along said optimal path, starting from the destination node to the BBQ being directly connected to said source node, such that whenever said selected packets are forwarded to one of said BBQs, the address of the current BBQ is removed from the header of said selected packets, thereby revealing the address of the next BBQ, for allowing said current BBQ to forward said packets, until said packets reach the destination node.

43. A data network according to claims 41 and 42, wherein each one of several optimal paths, between a source node and a destination node, include one intermediate node (RQnode) and each one of the remaining optimal paths

include at least two consecutive intermediate nodes (BBQs) that are connected to strategic points in the Internet, the addresses of said Routers and said BBQs being known to said source node, said source node being capable of determining which selected packets should be forwarded to the destination node via a Router (RQnode) or BBQs, and, accordingly, selecting the corresponding HMR rule, according to which the header of the corresponding packets is to be modified.

44. A data network according to claims 41 and 42, wherein one, or more, optimal path(s) comprise(s) a combination of RQnode(s) and BBQ(s), being utilized as intermediate nodes, and the first/second HMR rules are employed by the corresponding source/BBQ node according to said combination.

45. A data network according to claims 41 and 43, wherein according to the first HMR rule, the address of the source node is replaced in the header of the selected packets, by said source node, with the address of the destination node, by employing the Internet Communication Massage Protocol (ICMP), in order to cause the corresponding intermediate node Router (RQnode) to forwarded said selected packets to said destination node.

46. A data network according to claim 24, wherein the preselected alternative paths include a path that is a default path, which allows transferring data between the source node and the destination node by utilizing conventional software packages.